Citation:

Wang YF, Chiu JS, Chuang MH, Chiu JE, Lin CL. Bone mineral density of vegetarian and non-vegetarian adults in Taiwan. *Asia Pac J Clin Nutr.* 2008;17(1):101-6.

PubMed ID: 18364334

Study Design:

Cross-sectional Analysis of Retrospective Cohort

Class:

D - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To explore the effects of two different diets, vegetarian and non-vegetarian, on bone mineral density values in an adult Taiwanese population.

Inclusion Criteria:

- Adult male and female patients admitted to a regional teaching hospital in Taiwan between February 2003 and February 2004.

Exclusion Criteria:

- Notable osteopathy such as traumatic fracture or compressive fracture
- Osteomyelitis or other inflammatory osteopathy
- Scoliosis or poor posture
- Degenerative changes of the spinal cord or bone spur formation
- Surgically or medically-induced menopause

Description of Study Protocol:

Recruitment

Adult male and female patients underwent routine examination in a regional teaching hospital in Taiwan between February 2003 and February 2004.

Design: Cross-sectional Analysis of Retrospective Cohort

Blinding used (if applicable): not applicable

Intervention (if applicable): not applicable

Statistical Analysis

- Subjects were grouped according to sex and diet, and then were stratified by age within each of the four groups
- For the analysis of age-related bone mineral density changes, subjects were classified into seven age groups, from 20 to 89 years, divided in decades
- Mann-Whitney U test was used to compare the differences for each age group
- Means and 95% confidence intervals for bone mineral density were calculated
- Chi-square test was used to study the associations between diet and other factors affecting bone health, such as milk drinking, calcium pills, hormone replacement therapy

Data Collection Summary:

Timing of Measurements

Measurements made during routine examination.

Dependent Variables

- Bone mineral density measured by dual-energy X-ray absorptiometry on the right hip in men and on lumbar vertebrae L2 to L4 in women
- Incidence of osteopenia or osteoporosis according to defined criteria

Independent Variables

- Vegetarian (for at least 5 years) vs non-vegetarian, based on self-reported dietary preference

Control Variables

- Age
- Milk drinking
- Calcium pills
- Hormone replacement therapy

Description of Actual Data Sample:

Initial N: 1,865 patients

Attrition (final N): 1,865 patients; 383 vegetarian men, 464 non-vegetarian men, 489 vegetarian women, 529 non-vegetarian women

Age: not described

Ethnicity: Taiwanese

Other relevant demographics:

Anthropometrics

Location: Taiwan

Summary of Results:

Key Findings

- Bone mineral density gradually declined with increasing age in Taiwanese men, while Taiwanese women showed a precipitous decrease in bone mineral density after the fifth decade
- However, there were no statistical differences in bone mineral density observed between vegetarians and non-vegetarians of either sex
- No significant associations were observed between the use of milk, calcium supplements, or hormone replacement and loss of bone density, except for in the group of non-vegetarian women, consumption of calcium pills was significantly associated with lower bone density (P = 0.016).

Bone Mineral Density (g/cm^2) in Adult Taiwanese, by Sex and Diet

Diet	Male	Female
Vegetarian	0.813 ± 0.127 (n = 383)	0.953 ± 0.179 (n = 489)
Non-vegetarian	0.829 ± 0.142 (n = 464)	0.968 ± 0.183 (n = 529)
P value	0.22	0.22

Other Findings

The proportion of subjects with osteopenia or osteoporosis also appeared comparable between vegetarians and non-vegetarians of either sex

Author Conclusion:

Bone mineral density shows an age-related decline in Taiwanese men and women, and eating a vegetarian diet does not appear to affect this decline. Further studies are necessary to elucidate the impact of individual dietary components on bone mineral density.

Reviewer Comments:

Based on self-reported dietary preference, subjects had to be vegetarian for at least 5 years. Authors note that the study contained mostly ovo-lacto-vegetarians. Collection of data on milk drinking, calcium pills, and hormone replacement therapy not described.

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions

1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes

3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions

1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	No
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	Yes
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	Yes
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	Yes
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	Yes
3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	???
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	???

3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	Yes
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes
6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	No
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	No
6.6.	Were extra or unplanned treatments described?	N/A

6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	N/A
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes
8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	???
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	No
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes

10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes